

Continued from 15(4):225-240, 1976.

10. *Pinus-Quercus* Associes of the Deciduous Woodland

INDICATOR SPECIES

<i>Chlosyne definita</i> (1)	<i>Strymon melinus</i>
<i>Callophrys leucania</i> (1)	<i>Hemiargus i. isola</i> (1)
<i>Thecla augustula</i> (1)	<i>Baeotes hisbon zonata</i>
<i>Thecla gabatha</i> (1)	<i>Symmachia tricolor hedemanni</i>
<i>Thecla clarina</i>	<i>Isapis agyrtus hera</i> (1)
<i>Thecla denarius</i>	<i>Anatole rossi</i>

CHARACTERISTIC SPECIES

<i>Papilio thoas autocles</i>	<i>Hamadryas februa gudula</i>
<i>Phoebis agarithe maxima</i>	<i>Hamadryas feronia farinulenta</i>
<i>Phoebis philea</i>	<i>Hamadryas g. guatemalena</i>
<i>Phoebis sennae marcellina</i>	<i>Limenitis iphicla</i>
<i>Eurema d. daira</i>	<i>Libytheana carinenta mexicana</i>
<i>Eurema mexicana</i>	<i>Eumaeus minyas</i>
<i>Eurema lisa</i>	<i>Calycopis beon</i>
<i>Eurema nise nelphe</i>	<i>Electrostrymon cyphara</i>
<i>Euptychia gemma freemani</i>	<i>Strymon yojoa</i>
<i>Euptychia mollina</i>	<i>Thecla brescia</i>
<i>Euptychia gigas</i>	<i>Hemiargus ceraunus zachaeina</i>
<i>Actinote guatemalena</i>	<i>Hemiargus huntingtoni</i>
<i>veraacruzis</i>	<i>hannoides</i>
<i>Thessalia t. theona</i>	<i>Everes c. comyntas</i>
<i>Junonia evarete</i>	<i>Leptotes cassius striata</i>
<i>Euptoietia hegesia hoffmanni</i>	<i>Mesene croceela</i>
<i>Mestra amymone</i>	<i>Peplia lamis molpe</i>

11. Littoral Woodland

INDICATOR SPECIES

Anaea morvus boisduvali

CHARACTERISTIC SPECIES

<i>Papilio thoas autocles</i>	<i>Morpho peleides montezuma</i>
<i>Parides p. polyzelus</i>	<i>Agraulis vanillae incarnata</i>
<i>Colias cesonia</i>	<i>Dryas julia moderata</i>
<i>Phoebis sennae marcellina</i>	<i>Heliconius cleobaea zorcaon</i>
<i>Phoebis argante</i>	<i>Heliconius ismenius telchinia</i>
<i>Phoebis agarithe maxima</i>	<i>Heliconius charitonius</i>
<i>Eurema albula</i>	<i>vazquezae</i>
<i>Eurema mexicana</i>	<i>Heliconius petiveranus</i>
<i>Eurema lisa</i>	<i>Anartia jatrophae luteipicta</i>
<i>Eurema nise nelphe</i>	<i>Anartia fatima venusta</i>
<i>Eurema proterpia</i>	<i>Biblis hyperia aganisa</i>
<i>Eurema nicippe</i>	<i>Hamadryas februa gudula</i>
<i>Eurema dina westwoodi</i>	<i>Hamadryas feronia farinulenta</i>

<i>Ascia m. monuste</i>	<i>Marpesia chiron</i>
<i>Anteos clorinde</i>	<i>Limenitis iphicla</i>
<i>Anteos maerula</i>	<i>Limenitis paraeca</i>
<i>Euptychia hesione</i>	<i>Eumaeus minyas</i>
<i>Euptychia hermes sosybius</i>	<i>Calycopis beon</i>
<i>Caligo memnon</i>	<i>Hemiargus ceraunus zachaeina</i>
<i>Melinaea lilis imitata</i>	<i>Everes c. comyntas</i>
<i>Mechanitis polymnia lycidice</i>	<i>Peplia lamis molpe</i>
<i>Mechanitis egaensis doryssus</i>	

12. Swamp Forest

INDICATOR SPECIES

Thecla antincus (1)*Eurybia lycisca* (2)

CHARACTERISTIC SPECIES

<i>Dimorphia fortunata</i>	<i>Euptychia metaleuca</i>
<i>Eurema albula</i>	<i>Euptychia themis</i>
<i>Eurema dina westwoodi</i>	<i>Euptychia hermes sosybius</i>
<i>Tithorea harmonia salvadoris</i>	<i>Euptychia libye</i>
<i>Melinaea lilis imitata</i>	<i>Caligo memnon</i>
<i>Mechanitis polymnia lycidice</i>	<i>Morpho peleides montezuma</i>
<i>Mechanitis egaensis doryssus</i>	<i>Heliconius cleobaea zorcaon</i>
<i>Mechanitis menapis saturata</i>	<i>Heliconius ismenius telchinia</i>
<i>Hypothyris lycaste dionaea</i>	<i>Heliconius petiveranus</i>
<i>Ithomia patilla</i>	<i>Heliconius charitonius</i>
<i>Oleria paula</i>	<i>vazquezae</i>
<i>Dircenna klugi</i>	<i>Pyrrhogyra hypensor</i>
<i>Pteronymia cottyto</i>	<i>Pyrrhogyra otolais neis</i>
<i>Greta oto</i>	<i>Hamadryas februa gudula</i>
<i>Greta nero</i>	<i>Hamadryas feronia farinulenta</i>
<i>Taygetes andromeda</i>	<i>Hamadryas g. guatemalena</i>
<i>Euptychia hesione</i>	<i>Calycopis beon</i>
	<i>Thecla marysas damo</i>

13. Mangrove Woodland

INDICATOR SPECIES

None.

CHARACTERISTIC SPECIES

The same as those for the Swamp Forest.

14. Recently Abandoned Milpas

INDICATOR SPECIES

Tmolus echion echiolus (1)*Mesene margaretta**Thecla ares* (1)

CHARACTERISTIC SPECIES

<i>Papilio thoas autocles</i>	<i>Phyciodes vesta</i>
<i>Appias drusilla poeyi</i>	<i>Phyciodes claudina guatemalena</i>
<i>Ascia m. monuste</i>	<i>Phyciodes a. ardyis</i>
<i>Colias cesonia</i>	<i>Phyciodes myia</i>
<i>Phoebis sennae marcellina</i>	<i>Phyciodes griseobasolis</i>
<i>Phoebis philea</i>	<i>Anartia jatrophae luteipicta</i>
<i>Phoebis argante</i>	<i>Anartia fatima venusta</i>
<i>Phoebis agarithe maxima</i>	<i>Dynamine mylitta</i>
<i>Eurema d. daira</i>	<i>Hamadryas februa gudula</i>
<i>Eurema boisduvaliana</i>	<i>Hamadryas g. guatemalena</i>
<i>Eurema mexicana</i>	<i>Marpesia chiron</i>
<i>Eurema proterpia</i>	<i>Limenitis paraeca</i>
<i>Eurema nicippe</i>	<i>Anaea aidea</i>
<i>Eurema lisa</i>	<i>Calycopis beon</i>
<i>Eurema nise nelphe</i>	<i>Strymon yojoa</i>
<i>Danaus gilippus strigosus</i>	<i>Thecla marsyas damo</i>
<i>Dryas julia moderata</i>	<i>Hemiargus ceraunus zachaeina</i>
<i>Euptoietia hegesia hoffmanni</i>	<i>Hemiargus huntingtoni</i>
<i>Chlosyne janais</i>	<i>hannoides</i>
<i>Chlosyne l. lacinia</i>	<i>Everes c. comyntas</i>
<i>Thessalia t. theona</i>	<i>Leptotes cassius striata</i>
	<i>Peplia lamis molpe</i>

15. Pastures

INDICATOR SPECIES

<i>Opsiphanes boisduvalii</i> (1)	<i>Evenus regalis</i> (1)
<i>Opsiphanes cassiae castaneus</i>	<i>Thecla cypria</i>
<i>Phyciodes eranites mejicana</i> (1)	<i>Thecla janais</i> (2)
<i>Hamadryas iphthime</i> (1)	<i>Thecla vibidia</i> (1)
<i>Limenitis erotia</i> (1)	<i>Thecla hecate</i> (2)
<i>Chlorippe pavon</i>	<i>Thecla ligurina</i> (1)
<i>Prepona laertes pallantias</i> (2)	<i>Thecla scopas</i>
<i>Anaea marthesia</i> (2)	<i>Ancylusis jurgensenii</i> (1)
<i>Callophrys goodsoni</i> (1)	<i>Anatole agave</i> (1)
<i>Atlides polybe</i>	<i>Theope eleutho</i>

CHARACTERISTIC SPECIES

<i>Papilio thoas autocles</i>	<i>Phyciodes claudina guatemalena</i>
<i>Appias drusilla poeyi</i>	<i>Phyciodes a. ardys</i>
<i>Ascia m. monuste</i>	<i>Phyciodes myia</i>
<i>Colias cesonia</i>	<i>Phyciodes griseobasolis</i>
<i>Phoebis sennae marcellina</i>	<i>Anartia jatrophae luteipicta</i>
<i>Phoebis philea</i>	<i>Anartia fatima venusta</i>
<i>Phoebis argante</i>	<i>Dynamine mylitta</i>
<i>Phoebis agarithe maxima</i>	<i>Hamadryas februa gudula</i>
<i>Eurema boisduvaliana</i>	<i>Hamadryas g. guatemalena</i>
<i>Eurema mexicana</i>	<i>Marpesia chiron</i>
<i>Eurema proterpia</i>	<i>Limenitis paraeca</i>
<i>Eurema lisa</i>	<i>Anaea aidea</i>
<i>Eurema nise nelphe</i>	<i>Calycopsis beon</i>
<i>Eurema dina westwoodi</i>	<i>Strymon yojoa</i>
<i>Eurema nicippe</i>	<i>Heterosmaitia palegon</i>
<i>Danaus gilippus strigosus</i>	<i>Thecla marsyas damo</i>
<i>Euptychia hermes sosybius</i>	<i>Thecla meton</i>
<i>Dryas julia moderata</i>	<i>Thecla tephraeus</i>
<i>Euptoieta hegesia hoffmanni</i>	<i>Hemiargus ceraunus zachaeina</i>
<i>Chlosyne janais</i>	<i>Hemiargus huntingtoni</i>
<i>Chlosyne l. lacinia</i>	<i>hannoides</i>
<i>Thessalia t. theona</i>	<i>Everes c. comyntas</i>
<i>Phyciodes vesta</i>	<i>Leptotes cassius striata</i>
<i>Phyciodes frisia tulcis</i>	<i>Peplia lamis molpe</i>

16. Hedgerows

INDICATOR SPECIES

<i>Callophrys miserabilis</i> (2)	<i>Thecla hassan</i> (1)
<i>Panthiades ochus</i> (1)	<i>Thecla hesperitis</i> (1)
<i>Thecla neora</i> (1)	<i>Thecla demonassa</i> (2)
<i>Thecla barajo</i> (2)	<i>Thecla ambrax</i> (1)

CHARACTERISTIC SPECIES

<i>Graphium e. epidaus</i>	<i>Anartia jatrophae luteipicta</i>
<i>Papilio thoas autocles</i>	<i>Anartia fatima venusta</i>
<i>Parides p. polyzelus</i>	<i>Metamorpha stelenes biplagiata</i>
<i>Eurema albula</i>	<i>Biblis hyperia aganisa</i>
<i>Eurema dina westwoodi</i>	<i>Dynamine mylitta</i>

<i>Oleria paula</i>	<i>Hamadryas februa gudula</i>
<i>Pteronymia cottyto</i>	<i>Hamadryas g. guatemalena</i>
<i>Euptychia hesione</i>	<i>Marpesia chiron</i>
<i>Euptychia themis</i>	<i>Limenitis iphicla</i>
<i>Euptychia hermes sosybius</i>	<i>Limenitis paraeca</i>
<i>Euptychia libye</i>	<i>Anaea aidea</i>
<i>Caligo memnon</i>	<i>Calycopis beon</i>
<i>Morpho peleides montezuma</i>	<i>Strymon vojoo</i>
<i>Dryas julia moderata</i>	<i>Heterosmaitia palegon</i>
<i>Heliconius cleobaea zorcaon</i>	<i>Thecla marysas damo</i>
<i>Heliconius ismenius telchinia</i>	<i>Thecla meton</i>
<i>Heliconius petiveranus</i>	<i>Thecla tephraeus</i>
<i>Heliconius charitonius</i>	<i>Charis velutina</i>
<i>vazquezae</i>	<i>Lymnas p. pixe</i>
<i>Phyciodes claudina guatemalena</i>	<i>Peplia lamis molpe</i>
<i>Phyciodes phillyra</i>	

In addition, the data indicate that a second division—less pronounced than the first but nonetheless significant—can be made. A comparison of the formations at relatively low altitudes indicates that the greatest diversity occurs between the species in the Lower Montane Rain Forest and the remaining formations. Indeed, 24 species (13 indicator, 11 characteristic) occur commonly only within the Lower Montane Rain Forest. This “uniqueness” is approached by only one other formation, the Semi-Evergreen Seasonal Forest, which has 25 species (23 indicator, two characteristic) found commonly only within its borders. Thus, a line separating the Lower Montane Rain Forest from all other formations at relatively low elevations can be drawn.

In conclusion, my analysis of the butterfly fauna has led me to the opinion that the classification system employed by Andrlé (1964) does not reflect accurately the existing relationships (at least for butterflies) but that the system originally expressed by Goldman (1951) is more applicable. Following the system employed by the latter, I divide the Sierra into two major zones: first, a Lower Tropical Zone, subdivisible into a Humid Lower Tropical Subzone (corresponding to the Humid Tropical Upper Subzone of Andrlé), and an Arid Lower Tropical Subzone (corresponding to the Arid Tropical Zone of Andrlé); and second, an Upper Tropical Zone, nondivisible and corresponding to

the Humid Tropical Upper Subzone of Andre. These zones and subzones are defined and characterized in Table III.

BIOTIC PROVINCE

The concept of the Biotic Province, originated by Vestal (1914) and developed by Dice (1943), by definition dictates that the entire Sierra de Tuxtla fall within only one category. This, according to Goldman (1951) and Goldman and Moore (1945) is the Veracruz Biotic Province, which "embraces the tropical lowlands from eastern San Luis Potosi, southern Tamaulipas, and northeastern Puebla, southwesterly through Veracruz and Tabasco and small portions of northern Oaxaca and Chiapas." However, I question the validity of including the Sierra within the "tropical lowlands" of Veracruz since the majority of the land surfaces within the range have an average elevation in excess of 1,000 feet and four volcanoes have maximum elevations in excess of 3,000 feet. Furthermore, most of the flora and fauna found at elevations in excess of 2,500 to 3,000 feet seem to have their affinities with forms common farther south. I conclude, therefore, that a new biotic province should be erected for the Sierra de Tuxtla.

TABLE III

LIFE ZONES AND CORRESPONDING PLANT FORMATIONS IN THE SIERRA DE TUXTLA

I. *Lower Tropical Zone*.—This zone is located from sea level to approximately 2,500 to 3,000 feet in altitude and probably receives an average annual rainfall of less than 150 inches. The zone is divisible into two subzones.

A. *Humid Lower Tropical Subzone*.—This subzone is found principally on the Gulf slopes of the major volcanoes below 2,500 to 3,000 feet where the average annual rainfall probably averages between 150 and 110 inches. Only one plant formation—Lower Montane Rain Forest—is included in this subzone.

B. *Arid Lower Tropical Subzone*.—This subzone is found principally along the coast and on the leeward slopes of the

major volcanoes below 2,500 to 3,000 feet, areas in which the average annual rainfall probably is less than 110 to 100 inches. This subzone includes the following plant formations:

Littoral Woodland

Mangrove Woodland

Swamp Forest

Savanna

Deciduous Woodland and the *Pinus-Quercus* Associes

Semi-Evergreen Seasonal Forest and the *Bursera-Sabal-Orbignya* Associes

II. *Upper Tropical Zone*.—This zone is located from approximately 2,500 to 3,000 feet in altitude to the peaks of the principal volcanoes (3,750 feet, 5,250 feet, and 5,450 feet for Volcáns San Martín Pajapan, Santa Marta, and San Martín Tuxtla, respectively) where the average annual rainfall probably is in excess of 150 inches. This zone includes the following plant formations:

Montane Rain Forest (the *Liquidambar-Quercus* Associes being an ecotone)

Montane Thicket

Elfin Woodland

Because the "Miscellaneous Formations" (Recently Abandoned Milpas, Pastures, and Hedgerows) occur throughout the Sierra where man has settled, I have not assigned these to any life zone.

AREAL DISTRIBUTION

Faunal-Floral Relationships

A total of 359 species of butterflies representing 133 genera and eight families now have been recorded from the Sierra de Tuxtla. Of these species, 258 (72%) are found primarily in open and relatively open plant formations throughout the range, and for the most part were collected in fields, pastures, and along hedgerows and the margins of forests. In general, members of the Lycaenidae and Riodinidae visit the blossoms of *Cordia spinescens* and *Calliandra grandiflora* very frequently; members of the genera *Hamadryas*, *Historis*, *Smyrna*, *Gynaecia*, *Prepona*, and *Anaea* (Nymphalidae) are attracted to fermenting sap oozing from the trunks of citrus trees and to fermenting juices of fallen fruit (principally mangoes); members of the genera *Papilio*, *Graphium* (Papilionidae), *Colias*, *Anteos*, *Phoebis*, *Eurema* (Pieridae), *Chlosyne*, *Phyciodes*, *Diaethria*, *Dynamine*, *Marpesia* (Nymphalidae), *Hemiargus*, *Leptotes*, and *Everes* (Lycaenidae) visit flowers (and damp earth) indiscriminately.

The interiors of forests with closed canopies are inhabited by a minority of butterfly species (101 species, 28% of total species). These species belong to 53 genera, 13 subfamilies and eight families and are listed in Table IV. From this table, certain correlations can be made. First, approximately 41% of the butterfly species inhabiting the forests of the Sierra de Tuxtla belong to the families Ithomiidae and Satyridae. Second, all members of the family Ithomiidae and the subfamily Lycoreinae (Danaiidae) occur within forests. Third, more than half the members of the Pierinae (five species, 55%) and Dismorphiinae (four species, 66%), (Pieridae), Satyrinae (19 species, 83%) and Brassolinae (three species, 60%) (Satyridae), and Amathusiinae (two species, 66%) (Nymphalidae) are found within forests. Fourth, relatively few species in the Lycaenidae (10 species, 11%) and the Riodinidae (13 species, 27%) occur within forests.

TABLE IV
 GENERA OF BUTTERFLIES COLLECTED IN THE
 SIERRA DE TUXTLA WITHIN FORESTS
 WITH CLOSED CANOPIES

(Numbers behind genera indicate number of species involved; numbers behind subfamilies indicate total number of species collected.)

A. Genera in which all species occur within forests

- Catasticta* (1) Pieridae:Pierinae (9)
- Archonias* (1) Pieridae:Pierinae
- Itaballia* (3) Pieridae:Pierinae
- Tithorea* (1) Ithomiidae:Ithomiinae (20)
- Melinaea* (1) Ithomiidae:Ithomiinae
- Mechanitis* (3) Ithomiidae:Ithomiinae
- Hypothyris* (1) Ithomiidae:Ithomiinae
- Napeogenes* (1) Ithomiidae:Ithomiinae
- Ithomia* (2) Ithomiidae:Ithomiinae
- Hyposcada* (1) Ithomiidae:Ithomiinae
- Oleria* (2) Ithomiidae:Ithomiinae
- Aeria* (1) Ithomiidae:Ithomiinae

Dircenna (1) Ithomiidae:Ithomiinae
Episcada (1) Ithomiidae:Ithomiinae
Pteronymia (1) Ithomiidae:Ithomiinae
Greta (3) Ithomiidae:Ithomiinae
Hypoleria (1) Ithomiidae:Ithomiinae
Lycorea (1) Danaidae:Lycoreinae (1)
Pierella (1) Satyridae:Satyrinae (23)
Pedaliodes (1) Satyridae:Satyrinae
Dioriste (1) Satyridae:Satyrinae
Eryphanis (1) Satyridae:Brassolinae (5)
Caligo (2) Satyridae:Brassolinae
Polygonia (1) Nymphalidae:Nymphalinae (90)
Myscelia (2) Nymphalidae:Nymphalinae
Eumaeus (2) Lycaenidae:Lycaeninae (88)
Theorema (1) Lycaenidae:Lycaeninae
Oenomaeus (1) Lycaenidae:Lycaeninae
Perophtalma (1) Riodinidae:Riodininae (42)
Leucochimona (2) Riodinidae:Riodininae
Mesosemia (2) Riodinidae:Riodininae
Eurybia (1) Riodinidae:Riodininae
Thisbe (1) Riodinidae:Riodininae
Polystichtis (1) Riodinidae:Riodininae

B. Genera in which half or more species occur within forests

Parides (5) Papilionidae:Papilioninae (21)
Dismorphia (4) Pieridae:Dismorphiinae (6)
Taygetes (4) Satyridae:Satyrinae (23)
Euptychia (12) Satyridae:Satyrinae
Morpho (2) Nymphalidae:Amathusiinae (3)
Epiphile (1) Nymphalidae:Nymphalinae (90)
Catonephele (1) Nymphalidae:Nymphalinae
Calycopis (2) Lycaenidae:Lycaeninae (88)
Euselasia (4) Riodinidae:Euselasiinae (6)

C. Genera in which less than half the species occur within forests

Graphium (2) Papilionidae:Papilioninae (21)
Eurema (3) Pieridae:Coliadinae (2)
Heliconius (1) Nymphalidae:Heliconiinae (17)
Chlosyne (1) Nymphalidae:Nymphalinae (90)
Phyciodes (1) Nymphalidae:Nymphalinae
Limnitis (1) Nymphalidae:Nymphalinae

- Prepona* (2) Nymphalidae:Nymphalinae
Anaea (3) Nymphalidae:Nymphalinae
Thecla (4) Lycaenidae:Lycaeninae (88)
Emesis (1) Riodinidae:Riodininae (42)

Although the species in the previously mentioned families and subfamilies share a common habitat type (tropical forest), they nonetheless have different preferred micro-habitats. The ithomiids usually are found in dank ravines in nonspecific butterfly assemblages and in the vicinities of four flowering plants: *Tournefortia glabra*, *Eupatorium macrophyllum*, *E. pittieri*, and *Psychotria padifolia*. The satyrids are more randomly distributed throughout the forests, *Taygetes* spp., *Dioriste tauropolis*, *Pediliodes pisonia circumducta*, *Eryphanis aesacus*, and *Caligo* spp. preferring montane formations and *Euptychia* spp. preferring less dense forest formations. The single species of *Lycorea* (Danaiidae:Danainae) is found in relatively open areas within the Semi-Evergreen Seasonal Forest and the Lower Montane Rain Forest and usually in small butterfly assemblages. The five species (three genera) of Pierinae are found in the Lower Montane Rain Forest and the Semi-Evergreen Seasonal Forest and usually within nonspecific butterfly assemblages—*Catisticta n. nimbice* preferring less dense areas and *Archonias tereas* and *Itaballia* spp. preferring more dense and shaded locales. The four species of *Dismorphia* (Dismorphiinae:Pieridae) prefer the montane formations—*D. praxinoe* and *D. fortunata* the Lower Montane Rain Forest and *D. euryope* and *D. nemesis* the Elfin Woodland and Montane Thicket. The two species of *Morpho* (Amathusiinae:Nymphalidae) have very dissimilar ecologies—*M. polyphemus luna* prefers the montane formations above 3,000 feet and *M. peleides montezuma* prefers the Lower Montane Rain Forest and other forests at relatively low elevations. The ten species (five genera) of lycaenids and 13 species (eight genera) of riodinids are found in a variety of forests; all seem to prefer the relatively bright sections.

ALTITUDINAL DISTRIBUTION

The maximum altitude of the Sierra is relatively low (5,450 feet) and thus vertical temperature change is not great. It is reasonable to assume that the entire Sierra falls within the normal altitudinal range of most butterfly species. (Indeed,

species that are common in sunny fields along the coast and at relatively low altitudes frequently were seen sailing over the peaks of the highest volcanoes on sunny days.) Yet, as stated previously, the greatest diversity in the butterfly fauna occurs between the Upper and Lower Tropical Zones and so the obvious conclusion is that plant formations with their characteristic plants, some of which probably serve as larval and adult food plants, seem to be the principal factor governing butterfly distributions. In general, the majority of the butterfly species (320 species, 89%) in the Sierra are primarily residents of the plant formations below 2,500 to 3,000 feet (the Lower Tropical Zone); only 39 species (11%) are commonly found in the forests above approximately 3,000 feet in elevation (the Upper Tropical Zone).

Climatic Relationships

SEASONAL VARIATION IN

BUTTERFLY POPULATION DENSITIES

Although the climate of the Sierra de Tuxtla is relatively mild and uniform, enough diversity exists to produce a noticeable seasonal fluctuation in butterfly populations. In general, populations reach maximum densities in August, September, and October and minimum densities in January, February, March, and April. In fact, many species virtually disappear during the winter and spring months, even at relatively low elevations. Although many species of butterflies are known to migrate to other areas during the winter months (Williams, 1930, 1958), relatively few of these species (17 species, approximately 5%) occur in the Sierra. These are: *Graphium philolaus* (Papilionidae), *Eurema nicippe*, *E. albula*, *E. lisa*, *Phoebis statira*, *P. trite*, *P. philae*, *P. argante*, *P. sennae*, *Anteos maerula*, *Ascia monuste* (Pieridae), *Agraulis vanillae*, *Vanessa virginiensis*, *Junonia evarete*, *Marpesia chiron* (Nymphalidae), *Danaus plexippus*, and *D. gilippus* (Danaiidae). The majority (59%) of these belong to the family Pieridae.

During my residence in the Sierra, I saw butterfly movements (which possibly could be termed migrations) in July and August involving principally *Phoebis* spp. and *Marpesia chiron*. Each day hundreds of individuals were observed as they flew usually between ten and 30 feet above the ground and in a

northeasterly direction toward the Gulf. In addition, during the fall months populations of *Danaus plexippus* and *Vanessa virginiensis* increased, possibly because of an influx of migrants from the north. Therefore, because of the relatively few migrant species (approximately 5%), and because of a population increase during the fall of at least two species (*Danaus plexippus* and *Vanessa virginiensis*), I conclude that migrations are an insignificant factor in the reduction of the winter butterfly populations in the Sierra de Tuxtla.

An alternative and more plausible explanation is that many species undergo an egg, a larval, or pupal diapause during the winter period, possibly as a result of decreased amounts of daylight, reduced temperatures, and reduced rainfall, or, any combination of these. Unfortunately, there is little data to support this hypothesis for I observed diapause (larval) only in one species—*Anatole rossi* (Riodinidae; Ross, 1966).

Although spring-dry season population minima are the general rule, a few exceptions do exist. The seven species of *Graphium* (Papilionidae:Papilioninae), *Dismorphia jethys* (Pieridae:Dismorphiinae), and *Actinote guatemalena veraecruzis* (Nymphalidae:Acraeinae) have maximum population densities in spring and early summer. All of these species disappear subsequent to the commencement of the summer rains. Also, *Morpho theseus justiciae* (Nymphalidae:Amathusiinae) and *Actinote leucomelas* (Nymphalidae:Acraeinae) are common in March and April but then disappear completely only to reappear in September, October, and November. Thus, these last two species seem either to be double brooded and to have relatively lengthy immature stages or to undergo diapause during some stage in their life cycles. *Philaethria d. dido* is common only in the fall months!

DAILY VARIATIONS IN BUTTERFLY POPULATION DENSITIES

During any given season, daily cycles in population densities are evident. Generally, most butterfly species are strongly photopositive and reach maximum activity levels between 10:00 A.M. and noon. However, during the periodic cool spells during the winter and on days of heavy cloud cover, maximum activity periods are delayed from one to two hours.

The notable exceptions to the previous generalization are the two species of *Caligo* (Satyridae:Brassolinae), *Eurybia lycisca* (Riodinidae:Riodininae), and all members of the Ithomiidae. The caligos are decidedly crepuscular and frequently wander out of the forest habitats and into more open areas at dusk; the two specimens of *Eurybia lycisca* were collected as they flew in a very dark, dense thicket at 6:30 P.M.; and members of the Ithomiidae are active under practically all weather conditions (including fog and light rain) in addition to practically all hours of daylight (dawn to dusk).

Faunal Relationships

AFFINITIES AND ORIGINS

Although the Sierra has been open to animal and plant movements from the north and the range is sufficiently near the northern limits of the Neotropical region to permit an influx of Nearctic forms, the fauna and flora have remained essentially tropical. In his avi-faunal investigations, Andrle (1964) states that 43% of the avian species recorded in the Sierra have southern origins as compared to 26% with more northern affinities (the remaining percentage represents species with unknown or uncertain origins). Unfortunately, the science of butterfly zoogeography has not advanced to the state whereby the origins and affinities of most genera and species groups can be defined (see Hovanitz, 1958). However, several generalizations, correlations, and speculations can be made about the Sierra's butterflies.

First, of the 359 species representing 133 genera, only 77 species (21%) representing 45 genera (34%) ever have been recorded from within the borders of the United States (references: dos Passos, 1964; Ehrlich and Ehrlich, 1961). These species, which are listed in Table V, for the most part are found in open, sunny areas throughout the Sierra. Furthermore, of these 77 species, 47 (61%) are known to be breeding residents (reference: Klots, 1951); the remaining species, 30 (39%), enter the United States only as occasional strays. Thus, the majority of the species of butterflies in the Sierra (79%) do not occur even as strays just 500 miles to the north.

TABLE V
SPECIES OF BUTTERFLIES COLLECTED IN THE
SIERRA DE TUXTLA KNOWN TO OCCUR WITHIN
THE BORDERS OF THE UNITED STATES

Papilionidae (5 species, 25% of represented species)	
<i>Battus polydamas</i>	<i>Papilio thoas autocles</i>
<i>Parides arcas mylotes</i>	<i>Papilio anchisiades idaeus</i>
<i>Papilio polyxenes asterius</i>	
Pieridae (20 species, 54% of represented species)	
<i>Appias drusilla poeyi</i>	<i>Eurema d. daira</i>
<i>Ascia m. monuste</i>	<i>Eurema boisduvaliana</i>
<i>Colias cesonia</i>	<i>Eurema mexicana</i>
<i>Anteos clorinde</i>	<i>Eurema salome</i>
<i>Anteos maerula</i>	<i>Eurema proterpia</i>
<i>Phoebis sennae marcellina</i>	<i>Eurema lisa</i>
<i>Phoebis philea</i>	<i>Eurema nise nelphe</i>
<i>Phoebis argante</i>	<i>Eurema dina westwoodi</i>
<i>Phoebis agarithe maxima</i>	<i>Eurema nicippe</i>
<i>Phoebis statira jada</i>	<i>Nathalis iole</i>
Danaiidae (4 species, 100% of represented species)	
<i>Danaus p. plexippus</i>	<i>Danaus eresimus montezuma</i>
<i>Danaus gilippus strigosus</i>	<i>Lycorea ceres atergatis</i>
Satyridae (2 species, 8% of represented species)	
<i>Euptychia gemma freemani</i>	<i>Euptychia hermes sosybius</i>
Nymphalidae (31 species, 29% of represented species)	
<i>Dryadula phaetusa</i>	<i>Chlosyne l. lacinia</i>
<i>Agraulis vanillae incarnata</i>	<i>Chlosyne defnita</i>
<i>Dryas julia moderata</i>	<i>Thessalia t. theona</i>
<i>Heliconius petiveranus</i>	<i>Phyciodes vesta</i>
<i>Heliconius charitonius</i>	<i>Phyciodes frisia tulcis</i>
<i>vazquezae</i>	<i>Vanessa virginiensis</i>
<i>Euptoieta hegesia hoffmanni</i>	<i>Junonia evarete</i>
<i>Chlosyne janais</i>	

TABLE V (continued)

Nymphalidae (continued)

<i>Anartia jatrophae luteipicta</i>	<i>Hamadryas feronia farinulenta</i>
<i>Anartia fatima venusta</i>	<i>Marpesia chiron</i>
<i>Metamorpha stelenes</i>	<i>Marpesia petreus</i>
<i>biplagiata</i>	<i>Chlorippe pavon</i>
<i>Hypanartia lethe</i>	<i>Historis odius</i>
<i>Biblis hyperia aganisa</i>	<i>Anaea aidea</i>
<i>Mestra amymone</i>	<i>Anaea pithyusa</i>
<i>Eunica monima</i>	<i>Libytheana carinenta mexicana</i>
<i>Dynamine dyonis</i>	
<i>Hamadryas februa gudula</i>	

Lycaenidae (16 species, 21% of represented species)

<i>Eumaeus minyas</i>	<i>Strymon yojoa</i>
<i>Chlorostrymon s. simaethis</i>	<i>Strymon columella istapa</i>
<i>Chlorostrymon telea</i>	<i>Strymon bazochii</i>
<i>Calycopis beon</i>	<i>Hemiargus ceraunus zachaeina</i>
<i>Tmolus echion echiolus</i>	<i>Hemiargus i. isola</i>
<i>Tmolus azia</i>	<i>Everes c. comyntas</i>
<i>Callophrys miserabilis</i>	<i>Leptotes cassius striata</i>
<i>Strymon melinus</i>	<i>Celastrina argiolus gozora</i>

Second, of the 133 genera found in the Sierra, 58 (44%) have been recorded in the United States (reference: dos Passos, 1964). These, in addition to the number of species represented in the Sierra, the United States, and the relative number found within the Neotropical regions, are listed in Table VI. An analysis of the data presented in this table reveals that of the 58 genera, only 19 (33%) are represented by a greater number of species in the United States than in the Sierra, and that of these 19, only four (7%)—*Colias* (Pieridae), *Polygonia* (Nymphalidae), *Vanessa* (Nymphalidae), and *Callophrys* (Lycaenidae)—have a greater representation in the United States (Nearctic region) than in the entire Neotropical region. Lacking additional information, one may assume with some justification that the center of origin of a genus corresponds to the area containing the greatest number of species (Savage, 1958). Thus, I conclude that at least four genera of the 133 (3%) represented in the Sierra probably have Nearctic origins or at least have their greatest affinities with Nearctic forms and that the remaining genera (129, 97%) probably have Neotropical origins or have their greatest affinities with Neotropical forms.

Third, an analysis of the 37 species (excluding new, endemic species) that have not been recorded from the Sierra according to Hoffmann (1940)—10 range extensions within the state of Veracruz, 18 new state listings, and nine new national listings (Table VII)—reveals that 76% of the new listings (all but the 10 intrastate range extensions) are species with known distributions that are farther south than the Sierra. The remaining

TABLE VI
COMPARISON OF BUTTERFLY GENERA COMMON
TO THE SIERRA DE TUXTLA, THE UNITED STATES,
AND THE NEOTROPICAL REGIONS

Genus (and family)	No. of species in the Sierra de Tuxtla	No. of species in the United States	Relative no. of species in the Neotropical regions as compared to the Nearctic regions
Papilionidae			
<i>Graphium</i>	7	1	greater
<i>Battus</i>	3	2	greater
<i>Parides</i>	6	1	greater
<i>Papilio</i>	5	21	greater
Pieridae			
<i>Dismorphia</i>	6	1	greater
<i>Appias</i>	1	1	greater
<i>Ascia</i>	1	2	greater (4)
<i>Colias</i>	1	16	lesser
<i>Anteos</i>	2	2	same (2)
<i>Phoebis</i>	7	6	greater
<i>Eurema</i>	11	10	greater
<i>Nathalis</i>	1	1	same (1)
Danaiidae			
<i>Danaus</i>	3	3	same (3)
<i>Lycorea</i>	1	1	greater
Satyridae			
<i>Euptychia</i>	15	9	greater
Nymphalidae			
<i>Dryadula</i>	1	1	same (1)
<i>Agraulis</i>	1	1	same (1)
<i>Dryas</i>	1	1	same (1)
<i>Heliconius</i>	11	2	greater
<i>Euptoieta</i>	1	2	greater (3)

<i>Chlosyne</i>	5	29	greater
<i>Thessalia</i>	1	2	greater (?)
<i>Phyciodes</i>	10	11	greater
<i>Polygonia</i>	1	10	lesser
<i>Vanessa</i>	1	4	lesser
<i>Junonia</i>	1	2	greater
<i>Anartia</i>	2	2	greater
<i>Hypanartia</i>	2	1	greater
<i>Biblis</i>	1	1	same (1)
<i>Mestra</i>	1	2	same (2)
<i>Myscelia</i>	2	2	greater
<i>Eunica</i>	1	2	greater
<i>Diaethria</i>	2	2	greater
<i>Dynamine</i>	2	1	greater
<i>Hamadryas</i>	6	4	greater
<i>Marpesia</i>	4	4	greater
<i>Limenitis</i>	9	7	greater
<i>Chlorippe</i>	3	1	greater
<i>Historis</i>	1	2	same (2)
<i>Smyrna</i>	1	1	greater
<i>Anaea</i>	11	5	greater
<i>Libytheana</i>	1	2	greater
Lycaenidae			
<i>Eumaeus</i>	2	2	greater (3)
<i>Chlorostrymon</i>	2	3	greater
<i>Calycopis</i>	4	2	greater
<i>Tmolus</i>	3	2	greater
<i>Callophrys</i>	7	24	lesser
<i>Atlides</i>	1	1	greater
<i>Panhiades</i>	1	1	greater
<i>Strymon</i>	6	12	greater
<i>Thecla</i>	47	2	greater
<i>Hemiargus</i>	3	3	greater
<i>Everes</i>	1	1	greater (?)
<i>Leptotes</i>	1	2	greater
<i>Celastrina</i>	1	1	same (1)
Riodinidae			
<i>Eusclasia</i>	6	1	greater
<i>Calephelis</i>	3	9	greater
<i>Emesis</i>	4	2	greater

TABLE VII
NEW BUTTERFLY RECORDS FOR THE
SIERRA DE TUXTLA
(EXCLUDING NEW ENDEMIC SPECIES)

Species	Nearest Previous Recorded Locale	Associated Plant Formations
I. Intrastate range extensions		
<i>Graphium branchus</i> (Papilionidae)	Sierra Madre Oriental (Veracruz)	Semi-Evergreen Seasonal Forest
<i>Graphium belesis</i> (Papilionidae)	Sierra Madre Oriental (Veracruz)	Semi-Evergreen Seasonal Forest
<i>Graphium agesilaus neosilaus</i> (Papilionidae)	Sierra Madre Oriental (Veracruz)	No specific formation
<i>Dismorphia euryope</i> (Pieridae)	Sierra Madre Oriental (Veracruz)	Montane Thicket, Elfin Woodland
<i>Hamadryas g. guatemalena</i> (Nymphalidae)	Sierra Madre Oriental (Veracruz)	Unrestricted
<i>Prepona brooksiana</i> (Nymphalidae)	Coatepec, Veracruz	Montane Thicket
<i>Eumaeus debora</i> (Lycaenidae)	Sierra Madre Oriental (Veracruz)	Montane Rain Forest, Montane Thicket, Elfin Woodland
<i>Chlorostrymon s. simaethis</i> (Lycaenidae)	Sierra Madre Oriental (Veracruz)	Hedgerows
<i>Electrostrymon cyphara</i> (Lycaenidae)	Sierra Madre Oriental (Veracruz)	Lower Montane Rain Forest, Semi- Evergreen Seasonal Forest
<i>Thecla hecate</i> (Lycaenidae)	Sierra Madre Oriental (Veracruz)	Pastures
II. New state records		
<i>Taygetes kerea</i> (Satyridae)	Chiapas, Sierra Madre del Sur (México)	Deciduous Woodland and the <i>Pinus-Quercus</i> Associates
<i>Phyciodes griseo-basalis</i> (Nymphalidae)	Chiapas (México)	Recently Abandoned Milpas, Pastures
<i>Catagramma lyca</i> (Nymphalidae)	Tabasco, Chiapas, Oaxaca (México)	Lower Montane Rain Forest
<i>Limnitis erotia</i> (Nymphalidae)	Chiapas (México)	Pastures

Species	Recorded Locale Nearest Previous	Associated Plant Formations
<i>Limenitis sentia</i> (Nymphalidae)	Yucatán (México)	Swamp Forest, Pastures
<i>Anaea proserpina</i> (Nymphalidae)	Chiapas (México)	Montane Thicket, Elfin Woodland
<i>Strymon melinus</i> (Lycaenidae)	Oaxaca (México)	<i>Pinus-Quercus</i> Associes of the Deciduous Woodland
<i>Thecla thales</i> (Lycaenidae)	Chiapas (México)	<i>Liquidambar-Quercus</i> Associes of the Montane Rain Forest
<i>Thecla denarius</i> (Lycaenidae)	Tabasco (México)	<i>Pinus-Quercus</i> Associes of the Deciduous Woodland
<i>Thecla tera</i> (Lycaenidae)	Chiapas (México)	Lower Montane Rain Forest
<i>Thecla politus</i> (Lycaenidae)	Pacific Coast of México	Montane Rain Forest
<i>Perophtalma tullius</i> <i>lasius</i> (Riodinidae)	Chiapas (México)	<i>Liquidambar-Quercus</i> Associes of the Mon- tane Rain Forest
<i>Leucochimona v.</i> <i>vestalis</i> (Riodinidae)	Chiapas (México)	Lower Montane Rain Forest, Montane Rain Forest
<i>Isapis agyrtus hera</i> (Riodinidae)	Chiapas (México)	<i>Pinus-Quercus</i> Associes of the Deciduous Woodland
<i>Celephelis</i> sp. 2 (Riodinidae)	Tabasco (México)	Recently Abandoned Milpas, Pastures, Hedgerows
<i>Calydna venusta</i> (Riodinidae)	Oaxaca (México)	Semi-Evergreen Seasonal Forest
<i>Emesia lupina</i> (Riodinidae)	Guerrero (México)	Semi-Evergreen Seasonal Forest
<i>Polystichtis sudias</i> (Riodinidae)	Tabasco (México)	<i>Liquidambar-Quercus</i> Associes of the Mon- tane Rain Forest, Montane Rain Forest
III. New national records		
<i>Epiphile plutonia</i> (Nymphalidae)	Guatemala	Montane Thicket
<i>Limenitis oberthuri</i> (Nymphalidae)	Guatemala	Lower Montane Rain Forest

Species	Nearest Previous Recorded Locale	Associated Plant Formations
<i>Calycopis pisis</i> (Lycaenidae)	Guatemala	<i>Liquidambar-Quercus</i> Associates of the Montane Rain Forest
<i>Thecla ares</i> (Lycaenidae)	Guatemala	Recently Abandoned Milpas
<i>Thecla mulucha</i> (Lycaenidae)	Guatemala	Semi-Evergreen Seasonal Forest
<i>Thecla ambrax</i> (Lycaenidae)	Nicaragua	Hedgerows
<i>Thecla dodava</i> (Lycaenidae)	Panamá	Montane Rain Forest
<i>Thecla tamos</i> (Lycaenidae)	Costa Rica	Deciduous Woodland, Montane Rain Forest
<i>Theope eleutho</i> (Riodinidae)	Panamá	Pastures, <i>Pinus-Quercus</i> Associates of the Deciduous Woodland

percentage (24%) of new listings, representing ten species, are of species with distributions that are only slightly farther north than the Sierra. These ten species belong to genera that probably have had Neotropical origins.

In summary, I conclude that the butterfly fauna of the Sierra de Tuxtla is essentially tropical.

ENDEMISM

Following the Tertiary uplift of the Sierra de Tuxtla, the area has been subjected to relatively few physical disturbances. Other than several volcanic eruptions, ash falls, and lava flows, the flora has had a considerable span of time in which to develop and mature. Even during the relatively cool periods of the Pliocene and Pleistocene the proximity of the Gulf of Mexico with its warm, moist winds, probably caused a relatively small decrease in the Sierra's average yearly temperature (Dorf, 1959). However, during that period a slight shift in floral (and faunal) elements conceivably took place; specifically, an extension of the previously minor subtropical elements (Griscom, 1932, 1950) and possibly even the establishment of new immigrants from more northern areas. Subsequent to the Pleistocene, the climate has ameliorated, which in turn has caused the retreat of the

subtropical floral elements to relatively high elevations of the major volcanoes (and possibly the elimination of some forms) and the expansion once again of the more tropical elements (see Griscom, 1932, 1950). Today these latter predominate. Thus, since the Pleistocene relatively stable conditions have existed in the Sierra and there probably have been no major modifications in the flora and fauna by physical elements except minor volcanic disturbances and hurricanes—both of which have been relatively rare in occurrence. This stability in environment combined with geographic isolation make the area ideally suited for endemism both in flora and fauna. Firschein and Smith (1956) state that at least eight endemic forms of amphibians and reptiles have been reported from the range. Wetmore (1943) listed five birds and Lowery & Newman (1949) one additional bird endemic to the Sierra.

My investigations of the butterfly fauna revealed five endemic forms: three species, one subspecies, and one form (two of the species and the one subspecies still remain undescribed). These endemics are listed in Table VIII. The majority of these forms (four species, 89%) belong to the families Lycaenidae and Riodinidae, many members of which are known to have fairly restricted distributions. Furthermore, of these five endemics two occur in the high montane forests (Upper Tropical Zone) and three in the Lower Tropical Zone (Arid Lower Tropical Subzone). All endemics but one (*Callophrys* nr. *longula*) belong to genera that never have been recorded within the United States and which I conclude have had Neotropical origins.

TABLE VIII
BUTTERFLIES ENDEMIC TO THE SIERRA DE TUXTLA

Species	Endemic Form	Associated Plant Formations
<i>Morpho theseus justiceae</i> form <i>schwezeri</i> (Nymphalidae)	Form (but probably good subspecies)	Montane Rain Forest, Montane Thicket, Elfin Woodland
<i>Callophrys</i> nr. <i>longula</i> (Lycaenidae)	Species	Elfin Woodland
<i>Thecla</i> nr. <i>antincus</i> (Lycaenidae)	Species	Swamp Forest
<i>Anatole rossi</i> (Riodinidae)	Species	<i>Pinus-Quercus</i> Associates of the Deciduous Woodland

Theope eleutho Subspecies *Pinus-Quercus* As-
n. spp. sociates of the De-
(Riodinidae) ciduous Woodland,
Pastures

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APPENDICES

Appendix A

CHECK-LIST OF BUTTERFLY SPECIES COLLECTED

IN THE SIERRA DE TUXTLA

FAMILY PAPILIONIDAE

SUBFAMILY Papilioninae

TRIBE Graphiini

SUBTRIBE Graphiiti

1. *Graphium phaon* (Boisduval)
2. *Graphium branchus* (Doubleday)
3. *Graphium belesis* (Bates)
4. *Graphium philolaus* (Boisduval)
5. *Graphium epidaus epidaus* (Doubleday, Westwood, & Hewitson)
6. *Graphium agesilaus neosilaus* (Hoffer)
7. *Graphium calliste calliste* (Bates)

TRIBE Troidini

SUBTRIBE Battiti

8. *Battus polydamas* (Linnaeus)
9. *Battus belus varus* (Kollar)
10. *Battus laodamas copanae* (Reakirt)

SUBTRIBE Troiditi

11. *Parides photinus* (Doubleday)
12. *Parides montezuma* (Westwood)
13. *Parides polyzelus polyzelus* (Felder)
14. *Parides sesostris zestos* (Gray)
15. *Parides iphidamas* (Fabricius)
16. *Parides arcas mylotes* (Bates)

TRIBE Papilionini

17. *Papilio polyxenes asterius* Stoll
18. *Papilio thoas autocles* Rothschild & Jordan
19. *Papilio androgeus epidaurus* Godman & Salvin
20. *Papilio anchisiades idaeus* Fabricius
21. *Papilio victorinus victorinus* Doubleday

FAMILY PIERIDAE

SUBFAMILY Dismorphiinae

22. *Dismorphia (Dismorphia) praxinoe* (Doubleday)
23. *Dismorphia (Dismorphia) fortunata* (Lucas)
24. *Dismorphia (Dismorphia) euryope* (Lucas)
25. *Dismorphia (Acmepteron) nemesis* (Latreille)
26. *Dismorphia (Enantia) albania* (Bates)
27. *Dismorphia (Enantia) jethys* (Boisduval)

SUBFAMILY Pierinae

28. *Catantixia nimbice nimbice* (Boisduval)
29. *Archonias (Archonias) tereas* (Hübner)
30. *Appias (Glutophrissa) drusilla poeyi* (Butler)
31. *Leptophobia aripa elodia* (Boisduval)
32. *Itaballia (Itaballia) demophile calydonia* (Boisduval)
33. *Itaballia (Itaballia) pisonis kicaha* (Reakirt)
34. *Itaballia (Pieriballia) viardi viardi* (Boisduval)
35. *Ascia (Ascia) monuste monuste* (Linnaeus)
36. *Melete isandra* (Boisduval)

SUBFAMILY Coliadinae

37. *Colias (Zerene) cesonia* (Stoll)
38. *Anteos clorinde* (Godart)
39. *Anteos maerula* (Fabricius)

40. *Phoebis (Phoebis) sennae marcellina* (Cramer)
41. *Phoebis (Phoebis) philea* (Johansson)
42. *Phoebis (Phoebis) argante* (Fabricius)
43. *Phoebis (Phoebis) agarithe maxima* (Neumoegen)
44. *Phoebis (Phoebis) intermedia* Butler
45. *Phoebis (Rhabdodryas) trite* (Linnaeus)
46. *Phoebis (Aphrissa) statira jada* (Butler)
47. *Eurema (Eurema) albula* (Cramer)
48. *Eurema (Eurema) दौरा दौरा* (Godart)
49. *Eurema (Eurema) boisduvaliana* Felder & Felder
50. *Eurema (Eurema) xanthochlora* (Kollar)
51. *Eurema (Eurema) mexicana* (Boisduval)
52. *Eurema (Eurema) salome* (Felder)
53. *Eurema (Pyrisitia) proterpia* (Fabricius)
54. *Eurema (Pyrisitia) lisa* Boisduval & Le Conte
55. *Eurema (Pyrisitia) nise nelphe* (Felder)
56. *Eurema (Pyrisitia) dina westwoodi* (Boisduval)
57. *Eurema (Abaeis) nicippe* (Cramer)
58. *Nathalis iole* Boisduval

FAMILY ITHOMIIDAE

SUBFAMILY Ithomiinae

TRIBE Tithoreini

59. *Tithorea harmonia salvadoris* Staudinger

TRIBE Melinaeini

60. *Melinaea lilis imitata* Bates

TRIBE Mechanitini

61. *Mechanitis polymnia lycidice* Bates
62. *Mechanitis agaensis doryssus* Bates
63. *Mechanitis menapis saturata* Godman

TRIBE Napeogenini

64. *Hypothyris lycaste dionaea* Hewitson
65. *Napeogenes tolosa* (Hewitson)

TRIBE Ithomiini

66. *Ithomia leila* Hewitson
67. *Ithomia patilla* Staudinger

TRIBE Oleriini

68. *Hyposcada virginiana virginiana* (Hewitson)
69. *Oleria zea* (Hewitson)

70. *Oleria paula* (Weymer)
 71. *Aeria pacifica* Godman & Salvin

TRIBE Dircennini

72. *Dircenna klugi* (Geyer)
 73. *Episcada artena* (Hewitson)
 74. *Pteronymia cottyto* (Guérin)

TRIBE Godyridini

75. *Greta nero* (Hewitson)
 76. *Greta oto* (Hewitson)
 77. *Greta anetta* (Guérin)
 78. *Hypoleria cassotis* (Bates)

FAMILY DANAIDAE

SUBFAMILY Danainae

79. *Danaus (Danaus) plexippus plexippus* (Linnaeus)
 80. *Danaus (Tasitia) gilippus strigosus* (Bates)
 81. *Danaus (Tasitia) eresimus montezuma* Talbot

SUBFAMILY Lycoreinae

82. *Lycorea ceres atergatis* (Doubleday)

FAMILY SATYRIDAE

SUBFAMILY Satyrinae

83. *Pierella luna heracles* Boisduval
 84. *Taygetes mermeria excauata* Butler
 85. *Taygetes virgilia* (Cramer)
 86. *Taygetes andromeda* (Cramer)
 87. *Taygetes keneza* Butler
 88. *Taygetes kerea* Butler
 89. *Euptychia gemma freemani* (Stalings & Turner)
 90. *Euptychia hesione* (Sulz)
 91. *Euptychia metaleuca* (Boisduval)
 92. *Euptychia mollina* Hübner
 93. *Euptychia labe* Butler
 94. *Euptychia similis* Butler
 95. *Euptychia themis* Butler
 96. *Euptychia undina* Butler

97. *Euptychia disaffecta* Butler & Druce
98. *Euptychia hermes sosybius* (Fabricius)
99. *Euptychia gigas* Butler
100. *Euptychia libye* (Linnaeus)
101. *Euptychia glaucina* Bates
102. *Euptychia sericella* Bates
103. *Euptychia* nr. *alcinoe* Felder
104. *Pedaliodes pisonia circumducta* (Thieme)
105. *Dioriste tauropolis* (Doubleday & Hewitson)

SUBFAMILY Brassolinae

106. *Opsiphanes (Opsiphanes) boisduvalii* Westwood & Hewitson
107. *Opsiphanes (Opsiphanes) cassiae castaneus* Stichel
108. *Eryphanis aesacus* (Herrich-Schaeffer)
109. *Caligo memnon* (Felder)
110. *Caligo uranus* Herrich-Schaeffer

FAMILY NYMPHALIDAE

SUBFAMILY Amathusiinae

TRIBE Morphini

111. *Morpho theseus justiciae* Salvin & Godman
112. *Morpho polyphemus luna* Butler
113. *Morpho peleides montezuma* Guénée

SUBFAMILY Acraeinae

TRIBE Acraeini

114. *Actinote leucomelas* (Bates)
115. *Actinote guatemalena veraecruzis* Jordan

SUBFAMILY Heliconiinae

116. *Philaethria dido dido* (Clerck)
117. *Dryadula phaetusa* (Linnaeus)
118. *Agraulis vanillae incarnata* (Riley)
119. *Dione junio huascama* (Reakirt)
120. *Dione moneta poeyii* (Butler)
121. *Dryas julia moderata* (Stichel)
122. *Heliconius (Eueides) cleobaea zorcaon* (Reakirt)

123. *Heliconius (Semelia) vibilia vialis* (Stichel)
124. *Heliconius (Semelia) lineata* (Salvin & Godman)
125. *Heliconius (Semelia) aliphera gracilis* (Stichel)
126. *Heliconius (Heliconius) ismenius telchinia* Doubleday
127. *Heliconius (Heliconius) doris transiens* Staudinger
128. *Heliconius (Heliconius) sapho leuce* Doubleday
129. *Heliconius (Heliconius) sara veraepacis* Bates
130. *Heliconius (Heliconius) petiveranus* Doubleday
131. *Heliconius (Heliconius) charitonius vazquezae* Comstock
& Brown
132. *Heliconius (Heliconius) hortense* Guérin

SUBFAMILY Nymphalinae

TRIBE Argynididi

133. *Euptoieta hegesia hoffmanni* Comstock
134. *Chlosyne janais* (Drury)
135. *Chlosyne hippodrome* (Geyer)
136. *Chlosyne lacinia lacinia* (Geyer)
137. *Chlosyne erodyle* (Bates)
138. *Chlosyne defnita* Aaron
139. *Thessalia theona theona* (Ménétriés)
140. *Phyciodes (Phyciodes) vesta* (Edwards)
141. *Phyciodes (Eresia) frisia tulcis* (Bates)
142. *Phyciodes (Eresia) claudina guatemalena* (Bates)
143. *Phyciodes (Eresia) phillyra* (Hewitson)
144. *Phyciodes (Tritanassa) atronia* (Bates)
145. *Phyciodes (Tritanassa) ardys ardys* Hewitson
146. *Phyciodes (Tritanassa) eranites mejicana* (Roerber)
147. *Phyciodes (Tritanassa) myia* (Hewitson)
148. *Phyciodes (Tritanassa) griseobasolis* Roerber
149. *Phyciodes (Tritanassa) clara* (Bates)

TRIBE Nymphalini

150. *Polygonia g-argenteum* (Doubleday & Hewitson)
151. *Vanessa virginiensis* (Drury)
152. *Junonia evarete evarete* (Cramer)
153. *Anartia jatrophae luteipicta* Fruhstorfer
154. *Anartia fatima venusta* Fruhstorfer
155. *Metamorphia stelenes biplagiata* (Fruhstorfer)
156. *Metamorphia epaphus* (Latreille)
157. *Hypanartia lethe* (Fabricius)
158. *Hypanartia dione* Latreille

TRIBE Biblini

- 159.
- Biblis hyperia aganisa*
- Boisduval

TRIBE Eunicidi

160. *Mestra amymone* (Ménétriés)
161. *Pyrrhogyra hypensor* Godman & Salvin
162. *Pyrrhogyra edocla aenaria* Fruhstorfer
163. *Pyrrhogyra otolais neis* Felder
164. *Pseudonica flavilla canthara* (Doubleday)
165. *Temenis laothoe liberia* (Fabricius)
166. *Epiphile adrasta bandusia* Fruhstorfer
167. *Epiphile plutonia* Bates
168. *Catonephele nyctimus* (Westwood)
169. *Catonephele numilia esite* (Felder)
170. *Nessaea aglaura* (Westwood & Hewitson)
171. *Myscelia cyaniris* Doubleday & Hewitson
172. *Myscelia rogenhoferi* Felder
173. *Eunica monima* (Stoll)
174. *Eunica alcmena alcmena* Doubleday & Hewitson
175. *Catagramma lyca* Doubleday & Hewitson
176. *Catagramma titania* Salvin
177. *Catagramma casta* Salvin
178. *Diaethria anna* (Guérin)
179. *Diaethria astala* (Guérin)
180. *Dynamine mylitta* (Cramer)
181. *Dynamine dyonis* Geyer

TRIBE Ageroniidi

182. *Hamadryas februa gudula* (Fruhstorfer)
183. *Hamadryas feronia farinulenta* (Fruhstorfer)
184. *Hamadryas guatemalena guatemalena* (Bates)
185. *Hamadryas iphthime* (Bates)
186. *Hamadryas amphinome mexicana* (Lucas)
187. *Hamadryas laodamia laodamia* (Cramer)

TRIBE Marpesiidi

188. *Marpesia chiron* (Fabricius)
189. *Marpesia harmonia* (Klug)
190. *Marpesia corita* (Westwood)
191. *Marpesia petreus* (Cramer)

TRIBE Limenitidi

192. *Limenitis (Adelpha) melanthæ* (Bates)
193. *Limenitis (Adelpha) leuceria* (Druce)
194. *Limenitis (Adelpha) erotia* (Hewitson)
195. *Limenitis (Adelpha) oberthuri* (Boisduval)
196. *Limenitis (Adelpha) iphicla* (Linnaeus)
197. *Limenitis (Adelpha) basiloides* (Bates)
198. *Limenitis (Adelpha) felderi* (Boisduval)
199. *Limenitis (Adelpha) sentia* (Godman & Salvin)
200. *Limenitis (Adelpha) paraeca* (Bates)

TRIBE Apaturidi

201. *Chlorippe cherubina* (Felder)
202. *Chlorippe pavon* (Latreille)
203. *Chlorippe laure* (Drury)
204. *Historis odius* (Fabricius)
205. *Smyrna blomfieldia datis* Fruhstorfer
206. *Gynaecia dirce* (Linnaeus)

TRIBE Charaxidi

207. *Prepona demophon centralis* Fruhstorfer
208. *Prepona antimache gulina* Fruhstorfer
209. *Prepona amphimachus* (Fabricius)
210. *Prepona laertes pallantias* Fruhstorfer
211. *Prepona brooksiana* Godman & Salvin
212. *Anaea (Siderone) marthesia* (Cramer)
213. *Anaea (Zaretis) itys* (Cramer)
214. *Anaea (Zaretis) callidryas* (Felder)
215. *Anaea (Anaea) aidea* Guérin-Ménéville
216. *Anaea (Consul) fabius* (Cramer)
217. *Anaea (Consul) electra* (Westwood)
218. *Anaea (Memphis) eurypyle confusa* Hall
219. *Anaea (Memphis) artacaena* (Hewitson)
220. *Anaea (Memphis) pithyusa* (Felder)
221. *Anaea (Memphis) proserpina* (Salvin)
222. *Anaea (Memphis) morvus boisduvali* W. P. Comstock

SUBFAMILY Libytheinae

- 223.
- Libytheana carinenta mexicana*
- Michener

FAMILY LYCAENIDAE

SUBFAMILY Lycaeninae

TRIBE Theclini

SUBTRIBE Strymoniti

224. *Eumaeus minyas* Hübner
 225. *Eumaeus debora* Hübner
 226. *Theorema eumenia* Hewitson
 227. *Chlorostrymon simaethis simaethis* (Drury)
 228. *Chlorostrymon telea* (Hewitson)
 229. *Calycopis beon* (Cramer)
 230. *Calycopis trebula* (Hewitson)
 231. *Calycopis pisis* (Godman & Salvin)
 232. *Calycopis* sp. "C"
 233. *Tmolus echion echiolus* (Draudt)
 234. *Tmolus crolinus* (Butler & Druce)
 235. *Tmolus azia* (Hewitson)
 236. *Oenomaus ortygnus* (Cramer)
 237. *Callophrys (Cyanophrys) amyntor distractus* Clench
 238. *Callophrys (Cyanophrys) herodotus* (Fabricius)
 239. *Callophrys (Cyanophrys) leucania* (Hewitson)
 240. *Callophrys (Cyanophrys) miserabilis* (Clench)
 241. *Callophrys (Cyanophrys) goodsoni* Clench
 242. *Callophrys (Cyanophrys) agricolor agricolor* (Butler & Druce)
 243. *Callophrys (Cyanophrys) nr. longula* (Hewitson)
 244. *Atlides polybe* (Linnaeus)
 245. *Panthiades ochus* (Godman & Salvin)
 246. *Strymon melinus* Hubner
 247. *Strymon yojoa* (Reakirt)
 248. *Strymon columella istapa* (Reakirt)
 249. *Strymon bazochii* (Godart)
 250. *Strymon albata sedecia* (Hewitson)
 251. *Strymon serapio* (Godman & Salvin)

252. *Electrostrymon cyphara* (Hewitson)
253. *Cynus battus jalan* (Reakirt)
254. *Arawacus aetolus togarna* (Hewitson)
255. *Arawacus sito* (Boisduval)
256. *Heterosmaitia palegon* (Cramer)
257. *Allosmaitia pion* (Godman & Salvin)
258. *Evenus regalis* (Cramer)
259. *Thecla cypria* (Geyer)
260. *Thecla marsyas damo* (Druce)
261. *Thecla augustula* Kirby
262. *Thecla lisus* Stoll
263. *Thecla mavors* (Hübner)
264. *Thecla inachus carpophora* Hewitson
265. *Thecla neora* Hewitson
266. *Thecla laothoe* Godman & Salvin
267. *Thecla barajo* Reakirt
268. *Thecla jantias* (Cramer)
269. *Thecla hassan* (Stoll)
270. *Thecla meton* (Cramer)
271. *Thecla janthina janthodonia* Dyar
272. *Thecla* nr. *polibites* (Cramer)
273. *Thecla vibidia* Hewitson
274. *Thecla hecate* Godman & Salvin
275. *Thecla jebus* (Godart)
276. *Thecla brescia* Hewitson
277. *Thecla ligurina* Hewitson
278. *Thecla mycon* Godman & Salvin
279. *Thecla thales* (Fabricius)
280. *Thecla tephraeus* (Geyer)
281. *Thecla syncellus syncellus* (Cramer)
282. *Thecla minthe* Godman & Salvin
283. *Thecla empusa* Hewitson
284. *Thecla ares* Godman & Salvin
285. *Thecla ahola* Hewitson
286. *Thecla gabatha* Hewitson
287. *Thecla tarpa* Godman & Salvin
288. *Thecla maeonis* Godman & Salvin
289. *Thecla hesperitis* (Butler & Druce)
290. *Thecla denarius* (Butler & Druce)
291. *Thecla plusios* Godman & Salvin
292. *Thecla clarina* Hewitson

293. *Thecla demonassa* Hewitson
294. *Thecla tera* Hewitson
295. *Thecla coronata* Hewitson
296. *Thecla scopas* Godman & Salvin
297. *Thecla mathewi* Hewitson
298. *Thecla politus* Druce
299. *Thecla basalides* (Geyer)
300. *Thecla mulucha* Hewitson
301. *Thecla ambrax* Westwood & Hewitson
302. *Thecla dodava* Hewitson
303. *Thecla kalikimaka* Clench
304. *Thecla tamos* Godman & Salvin
305. *Thecla* nr. *antincus* Felder

TRIBE Plebejini

306. *Hemiargus* (*Hemiargus*) *ceraunus zachaeina* (Butler & Druce)
307. *Hemiargus* (*Echinargus*) *huntingtoni hannoides* Clench
308. *Hemiargus* (*Echinargus*) *isola isola* (Reakirt)
309. *Everes comyntas comyntas* (Godart)
310. *Leptotes cassius striata* (Edwards)
311. *Celastrina argiolus gozora* (Boisduval)

FAMILY RIODINIDAE

SUBFAMILY Euselasiinae

TRIBE Euselasiini

312. *Euselasia sergia* (Godman & Salvin)
313. *Euselasia hieronymi* (Godman & Salvin)
314. *Euselasia cheles aurantiaca* (Godman & Salvin)
315. *Euselasia cataleuca* (Felder)
316. *Euselasia pusilla* (Felder)
317. *Euselasia eubule* (Felder)

SUBFAMILY Riodininae

TRIBE Riodinini

318. *Hades noctula* Westwood
319. *Perophtalma tullius lasius* Stichel
320. *Leucochimona philemon nivalis* (Godman & Salvin)
321. *Leucochimona vestalis vestalis* (Bates)
322. *Mesosemia tetrica* Stichel
323. *Mesosemia gaudiolus* Bates
324. *Eurybia lycisca* Westwood
325. *Cremna umbra* (Boisduval)
326. *Ancylusis jurgensenii* (Saunders)
327. *Rhetus arcus thia* (Morisse)
328. *Isapis agyrtus hera* Godman & Salvin
329. *Notheme eumeus diadema* Stichel
330. *Calephelis fulmen* (Stichel)
331. *Calephelis* sp. 1
332. *Calephelis* sp. 2
333. *Charis velutina* (Godman & Salvin)
334. *Charis myrtea* (Godman & Salvin)
335. *Charis psaros* (Godman & Salvin)
336. *Charmona gynaea zama* (Bates)
337. *Baeotis hisbon zonata* Felder
338. *Lymnas pixe pixe* Boisduval
339. *Mesene margaretta* (White)
340. *Mesene croceola* Bates
341. *Symmachia rubina* Bates
342. *Symmachia accustrix* Westwood
343. *Symmachia tricolor hedemanni* (Felder)
344. *Phaenochitonia sagaris tyriotes* (Godman & Salvin)
345. *Anteros carausius carausius* Westwood
346. *Calydna venusta* Godman & Salvin
347. *Emesis liodes* Godman & Salvin
348. *Emesis mandana mandana* (Cramer)
349. *Emesis tenedia* Felder
350. *Emesis lupina* Godman & Salvin
351. *Tharops menander isthmiae* Godman & Salvin
352. *Thisbe irenea belides* Stichel
353. *Polystichtis sudias* (Hewitson)
354. *Anatole agave* (Godman & Salvin)

355. *Anatole rossi* Clench
 356. *Peplia lamis molpe* (Hübner)
 357. *Nymula calice mycone* (Hewitson)
 358. *Calociasma lilina* (Butler)
 TRIBE Theopini
 359. *Theope eleutho* Godman & Salvin

Appendix B

PLANTS IDENTIFIED FROM THE SIERRA DE TUXTLA

Acanthaceae

- Aphelandra aurantiaca* (Schiedw.) Lindl.
Odontonema callistachyum (S. & C.) Kuntze
Ruellia fluviatilis Leonard

Amaryllidaceae

- Agave* sp.

Anacardiaceae

- Spondias mombin* L.

Annonaceae

- Annona muricata* L.
Annona reticulata L.
Annona sp.

Apocynaceae

- Stemmadenia galeottiana* (A. Rich.) Miers.
Tabernaemontana citrifolia L.

Aquifoliaceae

- Ilex belizensis* Lundell
Ilex discolor Hemsl.
Ilex nitida (Vahl.) Maxim.

Araliaceae

- Dendropanax arboreus* (L.) D. & P.
Oreopanax capitatum (Jacq.) D. & P.
Oreopanax xalapense (H.B.K.) D. & P.

Aristolochiaceae

- Aristolochia asclepiadifolia* T. S. Brandeg.

Asclepiadaceae

- Asclepias woodsoniana* Standl. & Steyerm.
Asclepias tuberosa L.

Aspidieae

- Didymochlaena truncatula* (Swartz) J. Smith

Bombacaceae

- Bernoullia flammea* Oliver
Ceiba pentandra (L.) Gaertn.
Pachira aquatica Aubl.

Boraginaceae

- Cordia alliodora* (R. & P.) Cham.
Cordia spinescens L.
Heliotropium indicum L.
Tournefortia glabra L.

Burseraceae

- Bursera simaruba* (L.) Sarg. sens. lat.

Campanulaceae

- Centropogon affine* Mart. & Gal.

Caprifoliaceae

- Viburnum acutifolium* Benth.

Clethraceae

- Clethra macrophylla* M. & G.
Clethra suaveolens Turcz.

Combretaceae

- Terminalia amazonia* (Gmel.) Exell.

Compositae

- Ageratum conyzoides* L.
Baltimora recta L.
Bidens pilosa L. var. *bimucronata* (Turcz.) Schultz
Calea cacosmoides Less. (tentative)
Calea longipedicellata R. & G.
Calea zacatechichi Schlecht.
Conyza chilensis Spreng.
Eupatorium incomptum DC.
Eupatorium macrophyllum L.
Eupatorium pittieri Klatt
Eupatorium tuerckheimii Klatt, vel aff. (tentative)
Hidalgoa ternata Llave
Liabum dimidium Blake (tentative)
Liabum sp.
Melampodium divaricatum (Rich.) DC.
Melampodium kunthianum DC.
Melanthera angustifolia A. Rich.
Polymnia maculata Cav.
Schistocarpa sp.
Senecio sp.
Stevia rhombifolia (H.B.K.)

Vernonia argyropappa Buek.

Vernonia leiocarpa DC.

Convolvulaceae

Ipomoea pes-caprae (L.) Sweet

Ipomoea stolonifera (Cyr.) Gmel.

Corylaceae

Carpinus caroliniana Walt.

Cucurbitaceae

Anguria tabascensis Donn. Sm., vel aff.

Cycadaceae

Ceratozamia mexicana Brong. sens. lat.

Zamia loddigesii var. *angustifolia* (Regel) Schuster

Cyatheaceae

Alsophila schiedeana Presl.

Cyathea sp.

Cyperaceae

Bulbostylis papillosa Kukenth. (tentative)

Cyperus articulatus L.

Cyperus ligularis L.

Dichromena ciliata Vah.

Rhynchospora globosa (H.B.K.) R. & S.

Rhynchospora tuerckheimii Clarke

Dilleniaceae

Curatella americana L.

Saurauia sp.

Elaeocarpaceae

Sloanea sp.

Ericaceae

Gaultheria sp. (tentative)

Erythroxylaceae

Erythroxylon tabascense Britton

Euphorbiaceae

Acalypha diversifolia Jacq. var. *carpinifolia* (Poepp. & Endl.)

Muell.-Arg.

Acalypha unibracteata Muell.-Arg., vel aff.

Alchornea latifolia Sw.

Croton glabellus L.

Croton repens Schlecht.

Croton soliman Schlecht. & Cham.

Gymnanthes actinostemoides Muell.-Arg.

Jatropha curcas L., vel aff.

Rondelitia galeottii Standl., vel aff.

Fabaceae

Dussia mexicana (Standl.) Harms

Erythrina americana Mill.

Gliricidea sepium (Jacq.) Steud.

Fagaceae

Quercus conspersa Benth.

Quercus ghiesbreghtii Mart. & Gal., vel aff.

Quercus oleoides S. & C.

Quercus peduncularis Née, vel aff.

Quercus skinneri Benth.

Flacourtiaceae

Casearia nitida (L.) Jacq.

Casearia sylvestris Sw.

Pleuranthodendron mexicana (A. Gray) L. Wms.

Xylosma sp.

Gleicheniaceae

Gleichenia palmata (Schaffner) Moore

Gramineae

Aulonemia sp.

Cenchrus incertus M. A. Curtis

Chloris petraea Swartz

Distichlis spicata (L.) Greene (tentative)

Eragrostis sp.

Isachne arundinacea (Sw.) Griseb.

Paspalum pectinatum Nees

Paspalum plicatulum Michx.

Sporobolus cubensis Hetchc.

Guttiferae

Clusia salvinii Donn. Sm.

Rheedia edulis (Seem.) Tr. & Pl.

Vismia mexicana Schlecht.

Hamamelidaceae

Liquidambar styraciflua L.

Icacinaceae

Calatola sp.

Juglandaceae

Engelhardtia guatemalensis Standl.

Engelhardtia mexicana Standl.

Labiatae

Salvia shannonii Donn. Sm.

Lauraceae

Persea longipes (Schlecht.) Meissn.

Phoebe bourgeaouviana Mez

Phoebe mexicana Meissn.

Phoebe psychotrioides (Nees) Mez (tentative)

Leguminosae

Albizia idiopoda (Blake) B. & R.

Albizia sp.

Calliandra grandiflora (L'Her.) Benth.

Cassia fruticosa Mill. (tentative)

Cassia hispidula Vahl

Cassia occidentalis L.

Cassia spectabilis DC., vel aff.

Crotalaria vitellina Ker

Dalbergia sp. (tentative)

Erythrina mexicana Krukoff

Inga leptoloba Schlecht.

Inga spuria Humb. & Bonpl.

Pithecollobium arboreum (L.) Urb.

Vigna luteola (Jacq.) Benth. (tentative)

Magnoliaceae

Talauma mexicana (DC.) G. Don

Malpighiaceae

Byrsonima crassifolia (L.) DC.

Malvaceae

Hibiscus tiliaceus L.

Melastomaceae

Conostegia xalapensis (Bonpl.) DC.

Miconia argentea (Sw.) DC.

Miconia glaberrima (Schlecht.) Naud.

Meliaceae

Guarea sp. (tentative)

Meteoriaceae

Pilotrichella flexilis (Hedw.) Jaeg.

Monimiaceae

Siparuna andina (Tul.) A. DC.

Moraceae

Cecropia mexicana Hemsl.

Ficus cotinifolia H.B.K.

Ficus glaucescens (Liebm.) Miq.

Ficus obtusifolia H.B.K.

Ficus padifolia H.B.K.

Ficus spp.

Pseudolmedia oxyphyllaria Donn. Sm.

Musaceae

Heliconia latispatha Benth.

Myricaceae

Myrica cerifera L.*Myrica splendens* (Sw.) DC.

Myristicaceae

Virola guatemalensis (Hemsl.) Warb.

Myrsinaceae

Ardisia sp. (tentative)*Deherainia smaragdina* (Planch.) Decaisne

Myrtaceae

Eugenia sp. (tentative)

Orchidaceae

Elleanthus capitatus (R. Br.) Reichb.

Oxalidaceae

Oxalis neaei DC. sens lat.

Palmae

Astrocaryum mexicanum Liebm.*Chamaedorea elegans* Mart. (tentative)*Chamaedorea ernesti-augustii* Wendl. (tentative)*Chamaedorea tepejilote* Liebm.*Chamaedorea* sp.*Orbignya* sp.*Sabal* sp.

Passifloriaceae

Passiflora ambigua Hemsl.*Passiflora biflora* Lam.*Passiflora coriacea* Juss.*Passiflora serratifolia* L.

Pinaceae

Pinus oocarpa Schiede

Piperaceae

Piper auritum H.B.K., vel aff.*Piper cordovan* C. DC., vel aff.*Piper* spp.

Podocarpaceae

Podocarpus oleifolius D. Don

Polypodiaceae

Dryopteris sp.*Pteridium aquilinum* var. *caudatum* (L.) Sadele

Proteaceae

Roupala borealis Hemsl.

Pterobryaceae

Pterobryum densum (Schwaegr.) Hornsch.

Rhizophoraceae

Rhizophora mangle L.

Rosaceae

Hirtella racemosa Lam.

Rubiaceae

Borreria suaveolens Mey.

Cephaelis elata Sw.

Crusea calcocephala DC.

Deppea excelsa (H.B.K.) Standl., vel aff.

Hamelia longipes Standl.

Hamelia patens Jacq.

Hoffmannia lenticillata Hemsl.

Lindenia rivalis Benth.

Machaonia sp., vel aff. (tentative)

Psychotria padifolia H. & B. (tentative)

Psychotria sp.

Rondeletia strigosa (Benth.) Hemsl.

Rudgea cornifolia (H. & B.) Standl., vel aff.

Rutaceae

Zanthoxylum elephantiasis Macf.

Sapindaceae

Thouinidium decandrum (H. & B.) Radlk.

Saxifragaceae

Weinmannia pinnata L.

Schrophulariaceae

Escobedia laevis C. & S.

Lamourouxia viscosa H.B.K.

Stemodia durantifolia Sw., vel aff. (tentative)

Simaroubaceae

Picramnia andicola Tul., vel aff. (tentative)

Solanaceae

Solanum ochraceo-ferrugineum (Dunal) Fernald

Solanum schlechtendalianum Walp.

Solanum spp.

Theaceae

Saurauia sp. (tentative)

Tiliaceae

Apeiba tibourbous Aubl.

Belotia sp.

Luehea speciosa Willd.

Turneraceae

Turnera ulmifolia L.

Ulmaceae

Mirandaceltis monoica (Hemsl.) Sharp

Urticaceae

Boehmeria sp. (tentative)

Myriocarpa bifurca Liebm. (tentative)

Myriocarpa longipes Liebm.

Trema micrantha (L.) Blume

Urera elata (Sw.) Griseb.

Verbenaceae

Aegiphila costaricensis Moldenke

Lantana camara L.

Violaceae

Rinorea guatemalensis (Wats.) Bartlett